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ABSTRACT

This report details recent activities and impacts of the Eisenhower Mathematics and Science Consortia and Clearinghouse. Although the legislation that created the Consortia specified 13 areas of possible focus, only eight areas capture the primary services provided. The eight areas discussed in this report include collaboration and communication; improved programs and curricula; professional development; frameworks, standards, and assessment; telecommunications and technology; equity of access; informal education opportunities; and reaching out to the community. (ASK)

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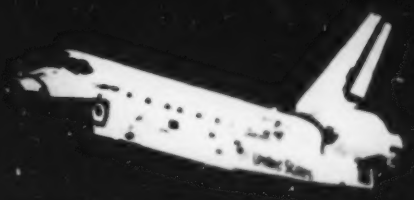

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THE EISENHOWER MATHEMATICS AND SCIENCE CONSORTIA AND CLEARINGHOUSE ARE PLEASED TO PRESENT THIS REPORT ON RECENT ACTIVITIES AND IMPACTS.

In just five short years, the Eisenhower Mathematics and Science Consortia and Clearinghouse (E=MSC^2) have become a dynamic regional and national school improvement support system. First funded by the U.S. Department of Education in 1992 to help improve mathematics and science education throughout the nation, each of the ten Consortia serves a U.S. Department of Education Regional Educational Laboratory region. They are assisted and supplemented by the Eisenhower National Clearinghouse (ENC) located at The Ohio State University. The working relationships and infrastructure the ENC and Consortia have built with each other and hundreds of partners across the country provide an effective mechanism for delivering services and products to extend mathematics and science education reform.

For example, the E=MSC^2 serves as a vital link in U.S. efforts to apply the results of the Third International Mathematics and Science Study (TIMSS). Not only are the Consortia and Clearinghouse disseminating the U.S. Department of Education's (USDOE) *TIMSS Resource Kit*, but they are also developing additional materials to assist educators explore TIMSS results. With their regional partners, the Consortia are providing professional development and technical assistance that will enable teachers and policymakers to learn from TIMSS in their efforts to improve mathematics and science teaching and learning.

TIMSS provides but one example of the many ways in which the Consortia and ENC collaborate to support excellence in the nation's classrooms. This report draws on selected activities to describe how E=MSC^2 members have worked together and with others during the past year to meet national, regional, state, and local needs in science and mathematics education improvement. Statistical information is taken from the E=MSC^2 national database, which has been capturing data on client services since October 1995. Activities have been selected to be representative of the breadth and depth of E=MSC^2 assistance in the focus areas, which were mandated by the legislation that created the network.

FOCUS AREAS

The legislation that created the Consortia specified 13 areas of possible focus. Across the Consortia, there are activities in each area, but the eight below capture the primary services provided.

1. **Collaboration and Communication** page 4
2. **Improved Programs and Curricula** page 6
3. **Professional Development** page 8
4. **Frameworks, Standards, and Assessment** page 10
5. **Telecommunications and Technology** page 12
6. **Equity of Access** page 14
7. **Informal Education Opportunities** page 16
8. **Reaching Out to the Community** page 18

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How To Connect

Write, telephone, telefax, or e-mail the Consortium in your region (see map on back cover) or the National Clearinghouse using the information in the directory below.

To connect to ENC, call toll-free with a modem and computer: (800) 362-4448; or with Internet access via the World Wide Web (http://www.enc.org); or telnet (enc.org) and login as guest. For more information call (800) 621-5785 or e-mail info@enc.org.

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THE EISENHOWER CONSORTIA AND CLEARINGHOUSE WORK COOPERATIVELY WITH OTHER MATHEMATICS AND SCIENCE EDUCATION ORGANIZATIONS AT THE LOCAL, STATE, REGIONAL, AND NATIONAL LEVELS.

COLLABORATION AND COMMUNICATION:
Helping Bring Efficiency and Coherence to All Levels

With their regional and national perspectives and a charge to work with others, the Consortia and Clearinghouse are in a unique position to identify and help knit together other efforts to improve science and mathematics education, from the local to the national levels.

To begin with just one local example, the WestEd Regional Eisenhower Consortium provides assistance to the San Diego Science Alliance. Founded in 1994, the Alliance has more than 100 member organizations from across San Diego County — science and technology-related firms, elementary and secondary schools, universities, scientific professional societies, research institutes, health networks, museums, municipal agencies, military science agencies, and informal education organizations. Members of the Alliance provide a variety of professional development experiences for teachers, for example, showing them how science and technology are practiced in industry. The Alliance also maintains an online Resource Catalog of programs to support mathematics and science educators. Now, in response to teacher requests, it is developing a "hotline" between San Diego-area scientists and schools to answer questions, interest students in scientific professions, and make science instruction current and meaningful. As for the role of the Consortium, "The WestEd Consortium has been a supportive bridge to state and national information and resources that has allowed us to rapidly develop successful links between the often disparate communities of scientists and educators," says Patricia Winter, Chair of the Alliance.

At the state level, Consortium support abounds. For example, the director of Florida State University's Science for Early Adolescence Teachers requested assistance from the Consortium at SERVE (Southeastern Regional Vision for Education) in publishing papers from teachers involved in action research. The purpose was to help teachers understand the nature of science and use it to design and implement student-centered curricula. The papers selected for publication covered topics such as integrating technology, alternative assessment, teaching to diversity, and cooperative learning.

Dissemination of the resulting publication involved collaboration with the Association for Education of Teachers and the National Association for Research in Science. The first 1,000 copies were gone in less than three months! Initial comments called it "extremely informative" and a "great resource." Another said, "This publication helped me to take a look at my own teaching methods and make improvements." It is now being used as a textbook at several teaching colleges. Requests have come from all corners of the international science education community, and the monograph is now available electronically through the ENC.

In 1993, the Mid-Atlantic Eisenhower Consortium at Research for Better Schools (RBS) brought together a Pennsylvania team to help the Commonwealth address mathematics and science education reform statewide. That coalition of over 100 educators recently established seven regional collaboratives within the state, which now reach all 501 school districts in Pennsylvania. Working with the Instructional Curriculum Coordinators from the state's 29 Intermediate Units, the regional collaboratives have each devised a plan to provide professional development for mathematics and science teachers in their area. Implementation of these plans is supported by up to $10,000 from the Consortium, plus resources from many other partners. Each state in the Mid-Atlantic region has a Consortium team.

Another example comes from the Northeast & Islands, where the Regional Alliance Consortium at TERC has established a network of school partnerships for intensive mathematics, science, and technology reform. The schools are linked with a state partner (e.g., someone from higher education, a National Science Foundation [NSF] Statewide Systemic Initiative [SSI], an informal education entity, or state department of education) to serve as a critical friend, supporter, and guide. In addition, the Consortium's nine Statewide Action

Teams identify resources and professional development opportunities to assist the schools. Finally, a Consortium staff member provides technical assistance, referrals, and other support.

These within-state partnerships have resulted in a rich and diverse range of supports. In Puerto Rico, for example, a group of 16 teachers attended a Consortium-sponsored Internet training session led by a media specialist at the University of Puerto Rico. This training was followed several weeks later by an advanced session for the same teachers. Through relationships built by the partners, two of the island's elementary schools have cooperated in undertaking teacher training in hands-on approaches to mathematics and science. As a result of the network built across these schools, teachers have begun to visit each other's buildings, plan and share activities, and learn about new and better approaches to mathematics and science teaching and learning.

As regional entities, the Consortia help states reach outside their boundaries to work with and learn from their neighbors. For example, four of the states served by the Eisenhower Consortium at the Southwest Educational Development Laboratory (SEDL) have received funds from NSF to mount SSIs. The Consortium has created an SSI Network to bring people from these four initiatives (Arkansas, Louisiana, New Mexico, and Texas) together regularly to discuss problems and solutions to implementing statewide systemic reform. Twice a year, key staff from the SSIs meet for two days to share and to discuss a focal topic. Usually, the participants are the SSI directors, staff members, and others working closely with the initiatives.

The High Plains Consortium at the Mid-continent Regional Educational Laboratory (McREL) has facilitated a similar but broader collaboration. In 1996, at meetings held in Denver and St. Louis, the Consortium brought together various federally funded service providers in education to share information about their work and to plan collaboration that could provide clients in the region with multiple points of entry and access to the services they offer as a group. The service providers included the Desegregation Assistance Centers, Comprehensive Assistance Centers, NSF-funded SSIs, and the Regional Technology in Education Consortia, as well as the Eisenhower Consortium and the Regional Educational Laboratories.

EISENHOWER CONSORTIA AND CLEARINGHOUSE PARTNERS

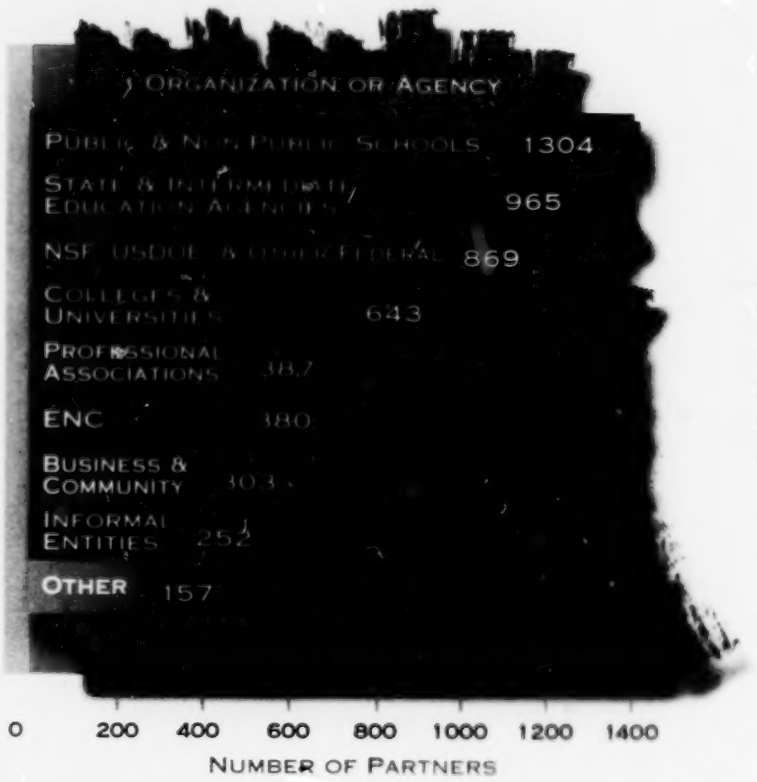


FIGURE 1

E=MSC² ACTIVITIES ENGAGE MANY OTHER COLLABORATING ORGANIZATIONS; OVER 5,000 PARTNERS WERE NAMED IN 2,346 ACTIVITIES FROM OCTOBER 1995 THROUGH SEPTEMBER 1997.

THE EISENHOWER CONSORTIA IDENTIFY AND DISSEMINATE EXEMPLARY MATHEMATICS AND SCIENCE MATERIALS, METHODS, AND ASSESSMENTS WITH AND THROUGH THE EISENHOWER NATIONAL CLEARINGHOUSE.

IMPROVED PROGRAMS AND CURRICULA:

Ensuring Quality at the Local Level and Scaling It Up to Benefit Others

Anyone who has tapped into the Eisenhower National Clearinghouse database knows that effective materials for teaching and assessing science and mathematics are available in abundance. But which ones for which communities? And how to help communities choose? The Consortia address these challenges in a variety of ways.

Consortia sometimes help an individual school or community draw on local resources to develop and provide the most effective — and culturally relevant — program and curriculum for its students. For example, the Southwest Consortium at SEDL supports a project at Los Padillas Elementary School in Albuquerque (NM) called Science as a Verb. Designed to intensively expose 11 teachers and the principal of the school to investigative learning strategies in science and mathematics, the project calls on the resources of the local endangered ecosystem, the Middle Rio Grande Valley. Delores Varela-Phillips, a naturalist resource teacher with the school, defines one of the project's goals as "giving the students a good scientific foundation so that they become informed, knowledgeable decision makers in the future." "This is especially important," she says, "because our students witness and live daily with some of the effects that encroaching urbanization is having on their environment and way of life, for example, polluted wells."

To accomplish its goals, the project depends heavily on the support and knowledge of the surrounding community, which is predominately rural and is one of the oldest Hispanic communities in the state. In planning a garden as a living textbook, the teachers interviewed Los Padillas residents about their uses of regional plants, and then integrated this local knowledge with information from computer-generated soil analyses and climate profiles. The teachers made scale drawings to produce the plan for the garden. By producing their own plan from this combination of sources, the teachers modeled for their students an approach to collecting and coordinating information to systematically reach new understandings.

As part of daily life, students help with weeding, planting, and general care of the several gardens they have now built. Both the gardens and a contiguous five-acre wildlife sanctuary provide an outdoor classroom for the teachers and students. The sanctuary features four native ecosystems, a pond, a trail system, and a seating area for about 50 people. Teachers use the sanctuary to help students with investigative techniques. Several gardens help students learn to identify plants, research the benefits of using native plants in landscapes, and become aware of the cultural significance of the native vegetation. For example, one of the gardens, built by first graders, is called the "Body Garden." Shaped like a body, each part of the garden is planted with species beneficial to or likely to be used to remedy an ailment of that part of the body.

Work in the project involves the collaboration of many groups. In addition to the Consortium, residents of the area, the school's teachers, faculty from the College of Education at the University of New Mexico, staff from the New Mexico Museum of Natural History and Science, and staff from the SSI cooperate in creating the learning space at Los Padillas.

In another part of the country, Alaska's Iditarod Area School District serves 415 young people whose homes are spread out across an area the size of Ohio. They attend small village schools that are often a hundred miles from the nearest neighboring village. Although 80 percent of the students are Native Alaskans, 90 percent of the teachers in the district are Caucasian, and the curriculum has emphasized textbook instruction based on the objectives, learning styles, and assessments of the dominant Western European culture. The long-range goal of the district's work with the Science and Mathematics Consortium for North West Schools at the Columbia Education Center is to turn the district's students from passive to active learners. The undertaking is called Yidon Xiga Xanatselniyh, which means We Are Doing Like Long Ago. Teachers are now turning to non-textbook cultural experiences in

mathematics and science. The project draws in the Native instructional staff (mostly teacher aides) and Tribal Elders and taps into their expertise as members of the local culture and communities. The elders share their wisdom and knowledge, including Native ways of viewing the environment — predicting weather; seasonal changes; animal patterns; use of animals and medicinal plants; cultural geography; making boats, fishnets, and clothing; etc. Other partners include NSF's Partners in Science and Rural Systemic Initiative programs.

And all Consortia strive to help schools, districts, and states meet one of the truly difficult challenges in education: finding ways to disseminate a program proven to be successful in one school setting to other schools — scaling it up. The Institute of Marine and Coastal Sciences at Rutgers University, with support from the Mid-Atlantic Eisenhower Consortium at RBS, is bringing an interdisciplinary marine science curriculum called Marine Activities Resource and Education (MARE) to New Jersey schools.

MARE, developed at the Lawrence Hall of Science at the University of California-Berkeley, has proved a success in schools in California, Texas and Oregon, and, most recently, in an elementary school in Flemington, New Jersey. MARE brings current marine science research into the classroom, thereby enabling students and teachers to utilize real-time data and incorporate field-based experiences into basic skills activities. The program contains a wealth of curriculum materials that supplement the current science, mathematics, and other activities in a school. Thirteen New Jersey schools sent staff to a one-week summer training program supported by the Eisenhower Consortium. The Institute, with assistance from the Consortium, is committed to follow-up efforts to scale-up MARE for use in schools throughout New Jersey.

METHODS OF DELIVERING RESOURCES

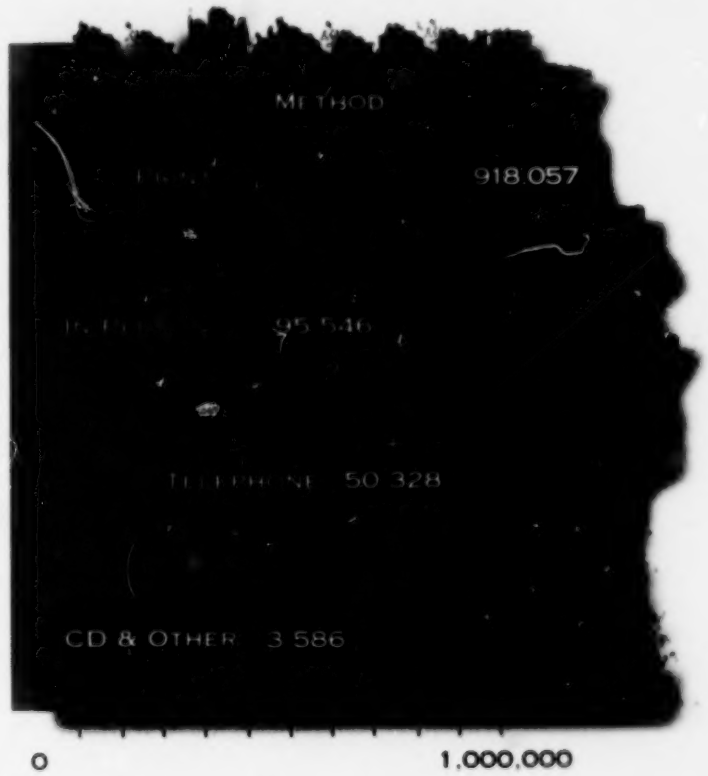


FIGURE 2

E=MSC² PROACTIVELY DELIVERS IMPROVEMENT RESOURCES ON A VERY LARGE SCALE USING MULTIPLE MEDIA. THERE WERE OVER 1,000,000 CLIENT CONTACTS FROM OCTOBER 1995 THROUGH SEPTEMBER 1997. AND THAT DOESN'T COUNT THE MORE THAN 13,000,000 "HITS" ON ENC AND CONSORTIA INTERNET SITES.

THE EISENHOWER CONSORTIA PROVIDE TRAINING FOR TEACHERS, ADMINISTRATORS, AND TRAINERS IN THE USE OF EXEMPLARY MATHEMATICS AND SCIENCE MATERIALS, METHODS, AND ASSESSMENTS. AND THE NATIONAL CLEARINGHOUSE SUPPORTS CONSORTIA EFFORTS BY COLLECTING AND MAKING AVAILABLE THE FULL TEXT OF A WIDE RANGE OF PROFESSIONAL DEVELOPMENT MATERIALS ONLINE AND ON CD-ROMS.

PROFESSIONAL DEVELOPMENT:

Helping Today's Teachers Become More Confident, Competent, and Effective

Since their inception, the Eisenhower Consortia and Clearinghouse have dedicated much of their energy and effort to improving the content knowledge and teaching skills of the current teaching force. Many of the nation's classroom teachers, particularly elementary teachers, did not receive vigorous mathematics and science courses as part of their own education and thus need additional training to comfortably and confidently teach mathematics and science effectively.

The Clearinghouse and Consortia are working with the U.S. Department of Education to enhance the Department's *TIMSS Resource Kit* on CD-ROM. In an effort to help educators use the results of TIMSS to improve their classroom practice, the Department and ENC have compiled materials from a variety of sources, including the video studies of mathematics teachers in the U.S., Japan, and Germany that are sparking discussion about the implications of differences in curriculum and instruction.

The Consortia work every day with those who provide professional learning opportunities for science and mathematics teachers. Early on, the Consortia turned to the regional laboratory-developed *Toolkit for Professional Developers* called *Facilitating Systemic Change in Science and Mathematics Education*. This toolkit helps to deepen knowledge about science and mathematics education, effective professional development, dissemination, and the process of change. The Eisenhower Consortium at SERVE has disseminated over 600 of these toolkits.

The toolkit has been used in SERVE's Technical Assistance Academy for Mathematics and Science Services (TAAMSS). Created for professional developers and lead teachers in the Consortium's six-state region, the Academy initially offered 85 service providers an opportunity to enhance their personal skills and knowledge about professional development. After joining TAAMSS, its members met in four intensive sessions (14 days total) to explore the content of the toolkit and its applications. Today, TAAMSS members report that they have trained 20,000 educators, drawing on content from the toolkit as a part of their work. Reflecting on her experiences with TAAMSS, Eileen Maness remarked, "In every way this has been the best staff development experience of my career. I am now designing and developing original presentations and practices; I am committed to hands-on, teacher-driven staff development; and I am reading the literature that will help me grow."

The first priority of the Science and Mathematics Consortium for North West Schools at the Columbia Education Center is professional development, especially as it pertains to fostering equal educational opportunity. Alaska's Lower Kuskokwim School District serves 3,357 students, primarily Yup'ik Eskimos, at small schools in 24 villages accessible to each other only by airplane. Professional development for these teachers in science content and science teaching methods is critical, particularly since most work in isolation, have little interaction with grade-level or subject-area peers, and face a perpetual shortage of resources.

As part of the district's overall professional development plan, a three-week institute was held in the summer of 1997. During the institute, teachers were immersed in sustained, intensive training in science education, with an added focus on how Yup'ik cultural beliefs affect students' perceptions of Western science. The Eisenhower Consortium helped in developing

the district's plan, provided follow-up technical assistance, and assisted in evaluating the outcomes. Third-grade teacher Cathy Moses returned to her Toksook Bay classroom enriched in several ways. "Now, even while I'm berry picking out on the tundra, I'm thinking about how my students think about the tundra," she said in late summer. "I also now see how I can use even the simple things around me as resources to help me make connections for my students."

A distinguishing characteristic of professional development provided by the Consortia is a focus on capacity building, whether among the professional developers of the Southeast, the teachers in a remote Alaskan village, or an NSF-supported Urban Systemic Initiative in Detroit.

The Midwest Consortium at the North Central Regional Educational Laboratory (NCREL) concentrates on working long-term across all layers of educational organizations. Working in partnerships, the Consortium facilitates change by helping to establish self-sustaining professional learning communities. For example, it is supporting such communities with the Detroit Urban Systemic Initiative — one for the members of 80 school leadership teams and another for a group of selected teachers.

The Consortium supported an intensive 16-hour course for administrators on Creating a Vision of Professional Development. Each participant was a member of a school team that also included at least four teachers, and the group became a professional learning network for administrators in the Detroit Public Schools. According to one principal, Mary Moore, the network "is the one avenue we [building principals] have for communicating with each other. It gives us a broad scope and common goals so that from building to building, we're all on the same page. We can then come together and share strategies that make us more effective with children." A colleague, Willie Trotter, concurs. "I want to know what the successes were so that I can try them," he says. "In addition, without a support group like the network provides, we get caught up in the daily grind and don't get a chance to stop and talk about what's important — excellence and achievement. Without it, we risk losing our vision."

A natural extension of the administrator institutes was the opportunity to begin working with teachers. A teacher group has also met monthly and begun to form the leadership nucleus for school-based professional development. Drawing on the case method pioneered at WestEd, the Midwest Consortium has been using mathematics problem-solving cases as the foundation for teachers to reflect on their practice and learn from these reflections and discussions with each other — the basis of a learning community.

CLIENTS OF CUSTOMIZED SERVICES

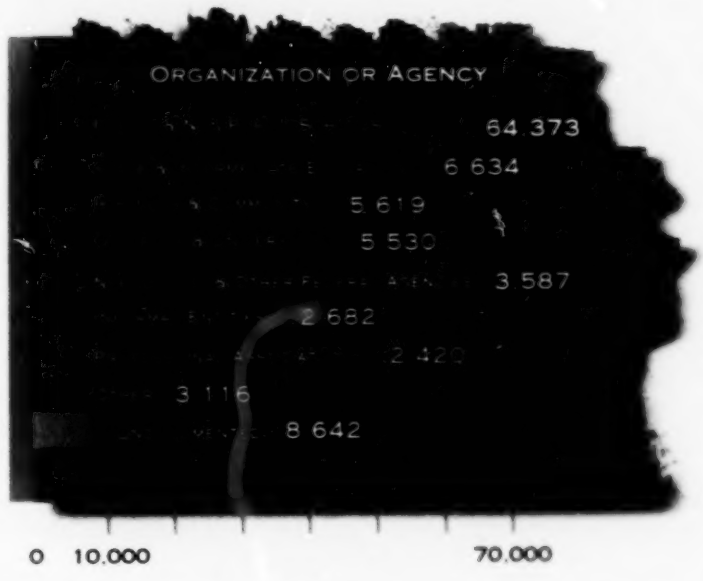


FIGURE 3

E=MSC² DELIVERS CUSTOMIZED SERVICES TO INDIVIDUALS AND GROUPS. THESE SERVICES INVOLVED OVER 100,000 CLIENT CONTACTS FROM OCTOBER 1995 THROUGH SEPTEMBER 1997. OVER 60% OF THE CLIENTS WERE SCHOOL-BASED. SOME OF THESE CLIENTS WENT ON TO ASSIST OTHER EDUCATORS BASED ON THE E=MSC² SERVICES.

THE EISENHOWER CONSORTIA AND CLEARINGHOUSE ASSIST STATES IN DEVELOPING AND IMPLEMENTING PERFORMANCE STANDARDS, CURRICULUM FRAMEWORKS, AND ASSESSMENTS THAT ARE BEGINNING TO REVEAL THEIR PROMISE FOR SYSTEMIC REFORM.

FRAMEWORKS, STANDARDS, AND ASSESSMENT:
Improving and Aligning State Curricula and Assessment

What do we expect students to know and be able to do? As a nation? In our states? Our communities? And our schools?

These apparently simple questions form the core of a major thrust in education reform, namely standard-based education. The premise is that we can describe our standards — what we want students to know and do in a given subject; that state and local districts can outline curriculum frameworks to ensure that instruction will enable students to meet the standards; and that we can then assess whether and to what degree students have achieved the desired level of proficiency. Organizations such as the National Council of Teachers of Mathematics and the National Academy of Science have developed voluntary national standards in their respective subject areas. Educators in most other states are grappling with adapting these national standards to meet state and local needs. In particular, they seek to help make the standards meaningful and useful for their districts, schools, and teachers.

In California, a grass-roots statewide science education network has accepted the challenge to do that. Since January 1995, the WestEd Eisenhower Regional Consortium and California's NSF-funded SSI have convened and supported the California Science Education Advisory Committee (CSEAC), a volunteer network of more than 35 organizations. These include statewide professional development groups, county offices of education, districts, informal science centers, the California Department of Education, U.S. Department of Energy national laboratories, institutions of higher education, business and industry, and parents.

The California Department of Education requested CSEAC to develop science standards for the Superintendent's Challenge Initiative for school districts. In response, CSEAC convened more than 700 educators statewide to coordinate and write these standards. An even larger cross-section of the science education community provided continuous input via hard-copy reviews, the World Wide Web, and regional conferences. The California Department of Education has distributed these standards to districts throughout the state, and CSEAC is working with the department and districts to help them use the standards.

Perhaps even more difficult to define, but just as important as standards, is the concept of curriculum frameworks. States all across the country are in various stages of writing or revising standards, curriculum frameworks, and benchmarks. Many call on their Eisenhower Consortium for assistance, in part because the Consortia can provide vital information about the national background on the issues as well as knowledge gained from others' experiences.

The High Plains Consortium at McREL has been working with both North Dakota and Missouri. Ann Clapper, Director of Curriculum, Leadership, and Improvement at the Department of Public Instruction in North Dakota, asked the Consortium to facilitate revising the state's Mathematics Framework and "doesn't know how we would have done it without them," she says. The revision of the framework, which was first proposed in 1993, provides an opportunity to increase awareness of the standards among the state's mathematics teachers in the hope that students will be better prepared with the necessary mathematics content and processes. In Missouri, the Consortium has worked with the Jefferson City High School mathematics and science departments to examine their own teaching units to see how effectively they prepare students for the new state assessments, and it has been training trainers at the St. Louis Regional Professional Development Center to develop a cadre of area teachers who can respond to the anticipated increase in requests for help following the release of the first new state assessment results.

The Consortium at the Appalachia Educational Laboratory (AEL) has established 33 regional teams of K-16 educators to provide training on the national standards, as well as the curriculum frameworks for each of the four states that it serves. Free workshops are available to every school in the region. As a result, in just one year 8,310 educators participated in Consortium-sponsored training. These trainings not only familiarize teachers with the standards and frameworks, but also assist teachers to use this knowledge in their classrooms. Teachers are shown how to move away from traditional lectures and seatwork to implement hands-on problem solving that connects students to real-world applications.

In the Northwest, the Eisenhower Consortium at the Columbia Education Center has partnered with Lower Quillayute Valley School District, the Olympic Natural Resources Institute, the University of Washington, and the Olympic Peninsula Educational Service District in supporting an innovative project on essential academic learning strategies. This initiative has brought together 60 teachers to match instructional activities to Washington state's legislatively mandated *Essential Academic Learning Requirements for Science*. Among other activities, at the conclusion of the workshop, the teachers develop World Wide Web pages to disseminate and share exemplary curriculum and teaching for the new science standards.

Dr. John Smith, professor of science education at the University of Washington, the major research institution in the state, served as faculty coordinator for the project. Smith noted the incredible level of teacher participation and commitment to professional development in this project and concluded at a faculty meeting, "that the University ought to use this model for providing direct service delivery to teachers—away from campus and in collaboration with other agencies and institutions—as a primary strategy for in-service professional development."

CONTENT OF CUSTOMIZED SERVICES

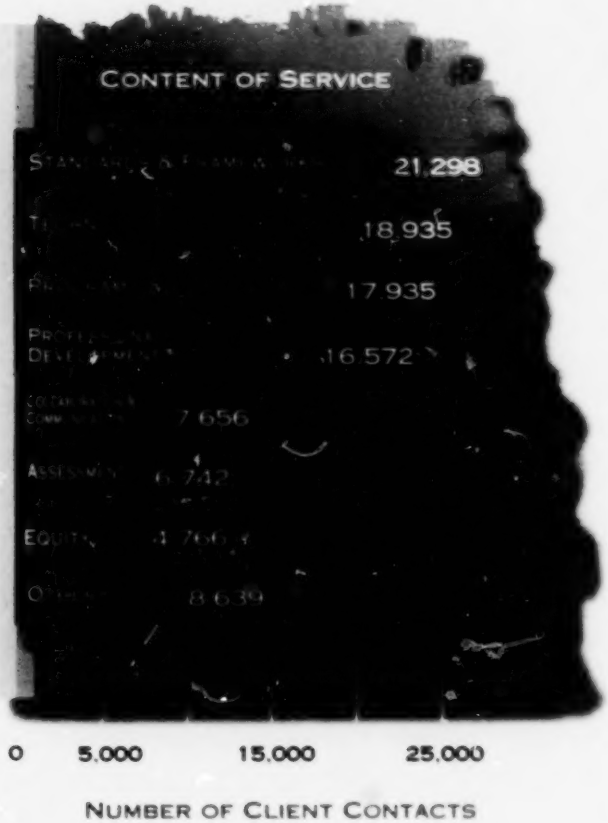


FIGURE 4

ALL SERVICES ARE DESIGNED TO IMPROVE MATHEMATICS AND SCIENCE LEARNING. THE PRIMARY CONTENT OF E=MSC² CUSTOMIZED SERVICES FROM OCTOBER 1995 THROUGH SEPTEMBER 1997 IS SUMMARIZED HERE. STANDARDS AND FRAMEWORKS, TECHNOLOGY, PROGRAMS AND CURRICULA, AND PROFESSIONAL DEVELOPMENT WERE THE MOST REQUESTED.

5

THE EISENHOWER CONSORTIA AND CLEARINGHOUSE FACILITATE THE USE OF TELECOMMUNICATIONS TECHNOLOGY AS A TOOL FOR INSTRUCTION AND PROFESSIONAL DEVELOPMENT IN MATHEMATICS AND SCIENCE EDUCATION.

TELECOMMUNICATIONS AND TECHNOLOGY:

Harnessing the Power of Technology to Advance Teaching and Learning

Computers and telecommunications are rapidly changing the ability to access and process information in all regions, even across remote Pacific islands, whose vast distances can now be bridged through electronics. With new technologies becoming more accessible to its clients, the Pacific Consortium at Pacific Resources for Education and Learning (PREL) is increasingly undertaking activities that have a high-technological focus. The Consortium now serves as the Pacific Network site for National Science and Technology Week, is a franchisee for Global Learning and Observations to Benefit the Environment (GLOBE), conducts the Hawaii Neighbor Island Technology Initiative (NITI) Seminars, has developed the Pacific Standards for Excellence CD-ROM, and electronically disseminates the *Voyages* newsletter and other information that help teachers locate and use technology in the classroom. Through this array of projects, the Pacific Consortium is attempting to lead students to better understand and utilize technology, help prepare teachers to use technology to enhance teaching and learning, and provide clients with increased access to important information.

NITI is supported by the Pacific Eisenhower Consortium and GTE Hawaiian Tel to further the effective integration of computer and telecommunications technology into the classroom. NITI consists of a series of one-day seminars and both online and face-to-face follow-up to help teachers integrate resources like computers, CD-ROMs, online communication, and the Internet into their classrooms and curricula in a meaningful way. The seminars include hands-on experience with the World Wide Web with "visits" to exemplary educational sites, sharing strategies for using technology to support curriculum, and a showcase of products and activities carried out by students and schools in Hawaii. Follow-up services include access to an ongoing electronic discussion and the opportunity to participate in a series of five Saturday workshops. These workshops were based on the *Learning with Technology* program developed at the North Central Regional Educational Laboratory.

Another Eisenhower Consortium whose clients span a large geographic space is the Regional Alliance at TERC, serving the Northeast & Islands. The schools working in closest partnership with the Consortium, for example, reach from western New York state to the eastern tip of St. Thomas in the U.S. Virgin Islands. One-third are located in small, isolated communities with little access to or experience with technology. Clearly, telecommunications offer an effective way for these geographically and demographically disparate schools to form a true network — learning about effective science and mathematics education from each other, and in the process acquiring technological knowledge and skills that can be put to use in their classrooms.

In the past year, the Consortium has taken several steps to bring these schools closer to each other and to provide them with access to the rest of the world through the Internet and the World Wide Web. First, the Consortium provided access to the Internet for those schools that were not yet connected. Second, it conducted workshops for all the schools, providing an introduction to the Web, or advanced use, depending on need. These workshops have focused not only on navigating the rich (and sometimes overwhelming) resources of the Internet, but on using the Web as a tool to serve classroom instruction. Third, to enable the schools to make their own contribution to the World Wide Web, the Consortium has made it possible for all the schools to quickly and easily create their own school web sites.

The Eisenhower Consortium at AEL joined with the University of Tennessee's Martin Center for Excellence in Science and Mathematics Education to train higher education faculty from 34 institutions across the region in integrating technology with instruction.

These faculty have, in turn, worked in teams to provide training and assistance to schools in their area on implementing appropriate technologies in science and mathematics classrooms. As one trainer reported, "It is exciting to see teachers learn to use the equipment and hear their plans for implementing changes in their own teaching as a result."

The Eisenhower Clearinghouse has always relied on technology to reach its vast national audience. In the last three years alone, ENC Online has had over 10,000,000 connections (hits) to its online servers. Because of this amount of traffic and the need to anticipate further growth, the Clearinghouse redesigned the site this year. Major refinements include a new home page and a more flexible browse structure, new links to mathematics and science Internet resources, and several exciting new features. For example, Innovator of the Month features a teacher who is putting new techniques or technology to work in the classroom, and the Professional Development Exchange provides educators with a means of locating workshops, meetings, and other professional development opportunities throughout the country. All the favorite features of ENC Online remain available, such as the full text of articles and standards documents and the Digital Dozen, 13 of the best Internet sites identified each month.

RESOURCES ON THE WORLD WIDE WEB

FIGURE 5

E-MSC' MAKES AVAILABLE EXTENSIVE RESOURCES THROUGH ELECTRONIC MEANS — ESPECIALLY WORLD WIDE WEB SITES AND E-MAIL LISTSERVS. FOR EXAMPLE, JUST A FEW TOPICS TO BE FOUND ON THE MIDWEST CONSORTIUM SITE ARE SHOWN HERE. ALL SITES ARE LINKED THROUGH ENC, THE KEYSTONE OF THE ELECTRONIC NETWORK.

THE CONSORTIA SUPPORT PROGRAMS AND ACTIVITIES DESIGNED TO MEET THE NEEDS OF GROUPS WHO ARE UNDERREPRESENTED AND UNDERSERVED IN MATHEMATICS AND SCIENCE EDUCATION.

EQUITY OF ACCESS:

Ensuring That All Students Get a Fair Chance to Succeed in Mathematics and Science

The Eisenhower Consortium at TERC, serving the Northeast & Islands, has formed and supported regional networks of educators committed to improving mathematics and science education. One of these networks, the Regional Equity Network, began early in 1994 with the formation of a steering committee made up of two representatives from each of the region's nine states and islands. These 18 representatives are all local, state, and national leaders in promoting and fostering equity in mathematics, science, and technology education. Together, this leadership group has developed and pursued increasingly long-range initiatives.

For example, the steering committee recruited a team from across the region to undergo 24 days of intensive training in prejudice reduction over a two-year period. The team participated in a series of three-day Equity in Mathematics Education Leadership Institutes (EMELI) designed and led by Dr. Julian Weissglass, nationally recognized for his pioneering work in prejudice reduction. Through the institutes, the team members have skills to assist K-12 mathematics educators with prejudice reduction related to gender, race, and socioeconomic status.

The EMELI team members also participate actively in a Consortium-supported listserv that enables them to discuss continuously how to apply lessons and resources gleaned from the EMELI events to their ongoing work as professional developers working with schools and districts. An NSF grant obtained by Dr. Weissglass covers most of the costs of the team's participation in EMELI; the Consortium has financed the balance and has facilitated several meetings of the team within the region to develop a long-term initiative to train trainers in prejudice reduction.

These EMELI trainers have begun to assist other Consortium partnerships in the Northeast & Islands region. With staff from the Consortium and schools, they are working to identify and address the ways in which the prejudices of teachers, administrators, guidance counselors, and others are impeding some students' academic achievement. This effort will expand exponentially as the EMELI team's training-of-trainers initiative unfolds in 1998 and beyond. Complementing the efforts of the EMELI team is a systemic reform handbook prepared by the Consortium that helps school districts use data to set goals for student achievement, monitor progress, and look at which students benefit from the change.

In the Appalachia region, the AEL Eisenhower Consortium is supporting local efforts designed to increase the skills, interest, and knowledge of students from populations traditionally underrepresented in mathematics and science education. Each year, through a competitive application process, the Consortium awards up to $750 in support to each of 40 classroom teachers to conduct innovative mathematics and science projects that will inspire and educate their students. Often these projects begin by bringing into the classroom things that creep, crawl, slither, or swim.

The visitors to the classroom of one award recipient at the Richlands Elementary School in Virginia were friendly bugs, insects, and amphibians from the school neighborhood. Science teacher Kathleen Osborne wanted to motivate her students, first graders who were reluctant or slow learners; so she brought the great outdoors indoors and provided students with a front-row seat to the wonders of nature. Students watched and cared for the "critters" and were particularly interested in those that metamorphose. When they talked about this experience to an evaluator, "It was neat to watch the caterpillars turn into butterflies and see the differences," and "We watched tadpoles grow and become frogs," were typical comments.

Through observation, the students also learned some hard things. For example, students overfed the fish at first and killed several of them. However, after quickly researching the problem and documenting what and how much food fish eat, they were able to successfully care for the remaining fish for the duration of the project. Students also talked about the link between what they had learned in the classroom and what they will do later in life (college or work plans). Several indicated an interest in becoming veterinarians, an interest sparked by observations of their fellow creatures. "It [the Consortium award] just made a world of difference in getting these children interested in science," Osburne reported at the close of the year.

The Consortia and ENC have worked together to provide those concerned with equity in the mathematics and science classroom with a CD-ROM of resource materials. The backbone of this equity CD-ROM is a compilation of equity articles originally gathered and published by a network-wide E=MSC² Equity Task Force. The Clearinghouse and the task force have enhanced those original articles and are disseminating them to a wider audience. The equity CD-ROM, *Making School Work for Every Child*, also includes classroom stories, vignettes, Internet links, and a listing of programs and sources of information, as well as the ENC Resource Finder catalog from which users can identify classroom materials targeting equity concerns.

KINDS OF CUSTOMIZED SERVICES

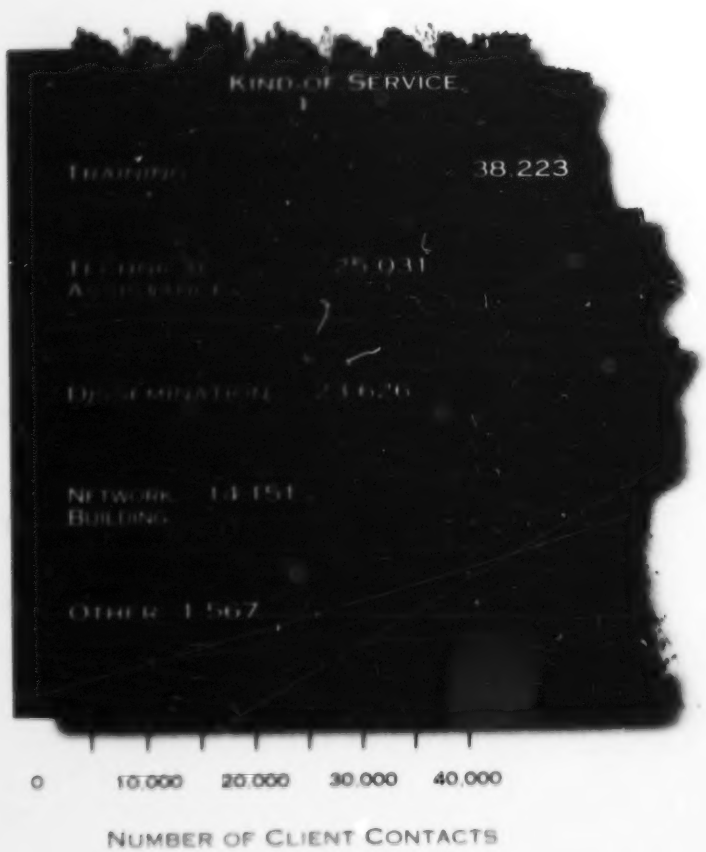


FIGURE 6

E=MSC² CUSTOMIZED SERVICES ARE DESIGNED TO PROVIDE THE KINDS OF ASSISTANCE CALLED FOR IN THE FUNDING LEGISLATION, TAILORED TO CLIENT NEEDS. OVER ONE-THIRD OF THE CLIENT CONTACTS WERE FOR TRAINING SERVICES FROM OCTOBER 1995 THROUGH SEPTEMBER 30, 1997. ALMOST ONE-QUARTER EACH WERE PRIMARILY TECHNICAL ASSISTANCE OR DISSEMINATION.

THE EISENHOWER NATIONAL CLEARINGHOUSE AND THE REGIONAL CONSORTIA DISSEMINATE INFORMATION ABOUT AND SUPPORT THE USE OF INFORMAL MATHEMATICS AND SCIENCE RESOURCES SUCH AS SCIENCE CENTERS, MUSEUMS, LIBRARIES, AND 4H PROGRAMS.

INFORMAL EDUCATION OPPORTUNITIES:
Increasing High Quality Science and Mathematics Experiences

Education occurs in many places and in many ways throughout our lives. Traditional, formal school settings are the most visible and familiar, but many informal, behind-the-scenes educational sites can have an enormous impact on a child's enthusiasm for exploring and learning new concepts. Many of these "hidden" places specialize in educating the public about various aspects of science. Science centers, zoos, parks, aquariums, aviaries, planetariums, museums, mines, gardens, and arboretums provide opportunities for fun and learning in interesting and novel settings. Some of these public science sites provide rich educational experiences for teachers. In addition to class field trips, many provide a variety of workshops and other resources to help teachers bring the excitement of science experiences into their classrooms.

For example, since the fall of 1994, a group of early childhood educators has gathered annually at the Georgia Youth Science and Technology Center (GYSTC) at Zoo Atlanta for an event called Adventures in Science. This special, one-day program features educational science programs and activities for an often-overlooked segment of the educational community — early childhood educators (pre-K -2). Developed in response to requests for help in introducing young children to the wonders of science, Adventures in Science serves as a platform to share ideas and network. Its sponsors include GYSTC, the SERVE Consortium, SciTrek, and the J.L. Hammet Co. Toni E. Smith of Dekalb County, Georgia, attended the first session and has returned every year since. Why? Because, "This is the first time that early childhood educators have had an opportunity to network and share ideas that will have an impact in the classroom," she claims.

In the Appalachian region, staff from informal education entities and teachers have worked together to develop standards-based activities for students to use before, during, and after visiting any one of the institutions. In 1996, the Appalachia Eisenhower Consortium began working with an informal education entity in each state of its region to help teachers learn how to make better use of them. The sites included an exhibition coal mine, an aquarium, a large urban science museum, and a small rural science center. Each institution formed a study group that consisted of its own staff and seven or eight local teachers. These groups developed standards-based activities for student use prior to visiting the institution, and designed follow-up activities for student use in the classroom and at home. In addition to talking about their experiences at a year-end conference, participants published their activities for others to use.

The Pacific Consortium at PREL has joined more than 15 other organizations in providing a powerful educational experience for high school students who spend three days at the Hawaiian Islands Humpback Whale National Marine Sanctuary. This Careers on the Water program not only highlights marine careers in the islands, but also provides whale watching and participation in shipboard activities. So far, approximately 200 students have participated, and volunteers from some 17 agencies have contributed upwards of 150 hours so that students and teachers can interact with specialists such as Dr. Alexander Malahoff from the University of Hawaii's (UH) Department of Oceanography, Dr. Lilikala Kame'eihiwa from the UH Department of Hawaiian Studies, and Nancy Murphy, the first woman harbor master in Honolulu.

But in most regions, finding informal education entities and learning about their programs and services can be a challenge. Many are small and unable to invest a lot of time or energy in advertising. Building on the directory the High Plains Consortium at McREL produced and disseminated last year for the Mid-continent region (both in print and online), the Consortia together have now built a national database, *Science Adventures*. The Consortia and

Clearinghouse have committed to maintaining this database to assist educators and parents in locating local resources for learning about science. The WestEd Eisenhower Consortium agreed to take the lead on the project. Each region collected information about local resources through personal contacts, mailings, and Internet searches. Criteria for inclusion were set, the database format was designed, and the information was collected and put online. The site is now available on the World Wide Web: http://www.scienceadventures.org.

Science Adventures currently contains information on over 1,000 resources and continues to grow. The collaboration among the ten Eisenhower Consortia, and between each consortium and the informal science centers, has led to a rich resource, promoting lifelong learning through a variety of science experiences. From a student-developed and operated wildlife and natural science museum in Petaluma, CA, to the Smithsonian Institution in Washington, DC, *Science Adventures* points to exciting learning experiences for all ages all across the country.

INTENSITY OF CUSTOMIZED SERVICES

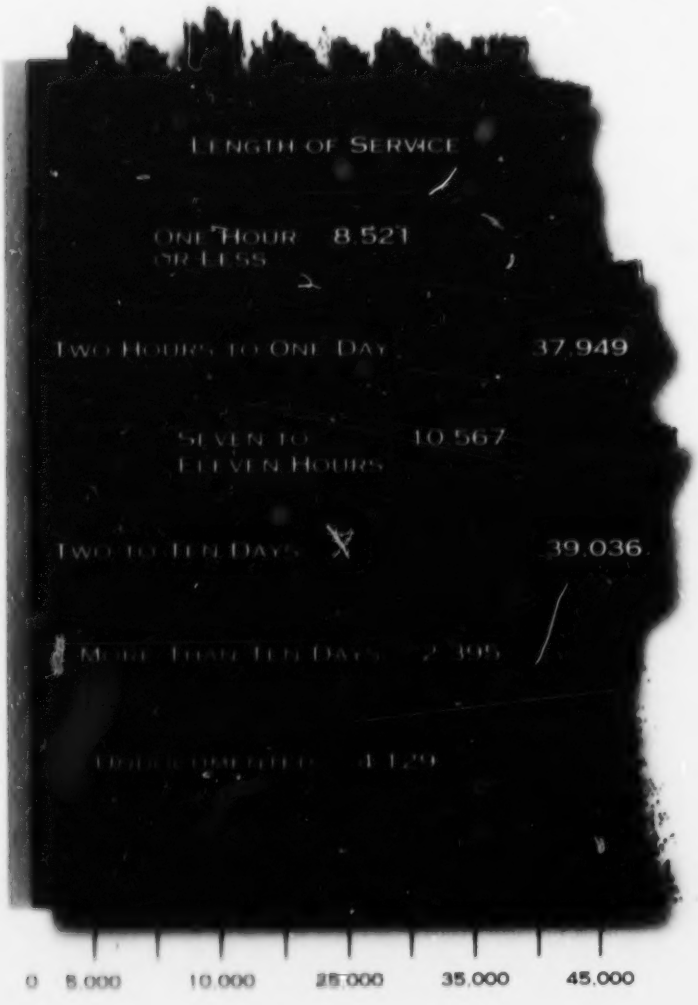


FIGURE 7

WHILE SHORT-TERM, JUST-IN-TIME ASSISTANCE CAN BE CRUCIAL TO THE SUCCESS OF MATHEMATICS AND SCIENCE EDUCATION IMPROVEMENT PROGRAMS, E=MSC² IS COMMITTED TO ENGAGE CLIENTS IN MORE INTENSIVE PROFESSIONAL DEVELOPMENT AND TECHNICAL ASSISTANCE EXPERIENCES. OVER 40% OF THE CLIENT [illegible]TS FROM OCTOBER 1995 THROUGH SEPTEMBER 1997 WERE FOR TWO DAYS OR MORE.

THE CONSORTIA SUPPORT COMMUNICATIONS TO AND ENGAGEMENT WITH COMMUNITY GROUPS CONCERNING SYSTEMIC IMPROVEMENT IN MATHEMATICS AND SCIENCE EDUCATION.

REACHING OUT TO THE COMMUNITY:
Engaging Parents and Community Members

For four years, the Southwest Consortium at SEDL has brought together people with various interests in education from throughout its five-state region for an annual Fall Forum. A recent forum focused on increasing community involvement in the reform of science and mathematics education. Consortium staff hoped that the most fruitful part of the experience would come after the participants went home, as the Consortium offered to help with follow-up spring forums in each state in the region. These state-specific forums could engage a wider public in understanding and working toward improving mathematics and science education, deepen the involvement of community leaders, and build cadres of people informed about education issues and connected through locally sustained networks.

Oklahoma was first to take up the offer. With Eisenhower Consortium support, the Oklahoma committee made sure that all regions of their state, as well as different approaches and viewpoints, were represented in planning a statewide forum. The resulting two-day meeting was well attended by people from all sectors of the community. According to Mary Stewart, President of the Coalition for the Advancement of Science and Mathematics in Oklahoma, the most important result of the meeting, however, was that "it created regional groups within the state. Since every area of the state is different, we expect that people will be more comfortable talking and learning in a regional rather than a statewide setting. With eight forums planned, we have a chance of bringing science and mathematics education to the forefront and helping people all over the state realize how important it is."

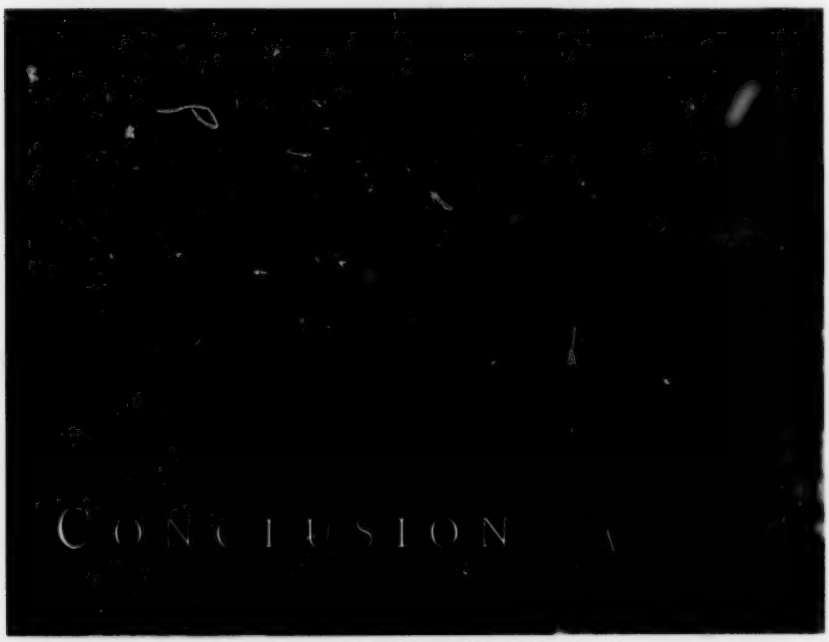
Next, the Arkansas forum involved more than 100 people in an exploration of resources available to broaden mathematics and science instruction in that state. The Louisiana forum brought informal science organizations and groups, such as museums, zoos, and curriculum enrichment programs, together with educators to examine the relationship between standards and state frameworks and classroom instruction. New Mexico's state forum focused on connecting parents and students in the improvement of mathematics and science education. Since each state is different, each has expressed its message differently, but in the end the hope is that all the forums will result in greater awareness of the needs and promises of improved mathematics and science education.

The Mid-Atlantic Consortium and the District of Columbia Public Schools have been working together and with other partners since 1995 to help community members understand school reform issues and learn how to identify exemplary mathematics and science instruction. For the Third Annual Public Outreach Campaign in April 1997, the Consortium partnered with the DC Public School's Mathematics, Science & Technology Initiative, the U.S. Department of Education, the National Parks Service, Scholastic, the American Association for the Advancement of Science, the National Academy of Sciences, Microsoft, and many others to launch the campaign with a signature event — the Mini-Village on the Mall: A Call for Partners. The purpose of this day was to demonstrate concrete examples of exemplary mathematics and science learning experiences and to identify additional partners for the DC Public Schools. Secretary of Education Richard Riley kicked off the event with Secretary of Health and Human Services Donna Shalala, Secretary of Transportation Rodney Slater, Astronaut Mary Ellen Weber, and the DC Public Schools Chief Academic Officer.

Students from DC schools participated in different events on the Mall. Students toured Scholastic's Magic *School Bus* and engaged in collaborative reading of books from Joanna Cole's Magic *School Bus* series with the Cabinet Secretaries and hundreds of adult volunteers from various federal agencies and the community. The students also visited interactive exhibits on the Mall, as well as the permanent exhibits of the surrounding Smithsonian museums. More than 50 organizations partnered with 53 schools to offer 166 events during the

month of April alone. More importantly, the public outreach campaign produced partnerships that have continued beyond the month-long celebration.

As Education Secretary Richard Riley has emphasized in his campaign to increase parent involvement in their children's schools, public outreach and education of the community are critical to improving learning opportunities for all children. Through public outreach activities, the Eisenhower Consortia and their partners are making the public increasingly aware of the need for all sectors of the community to contribute toward providing students with opportunities to learn to high standards.

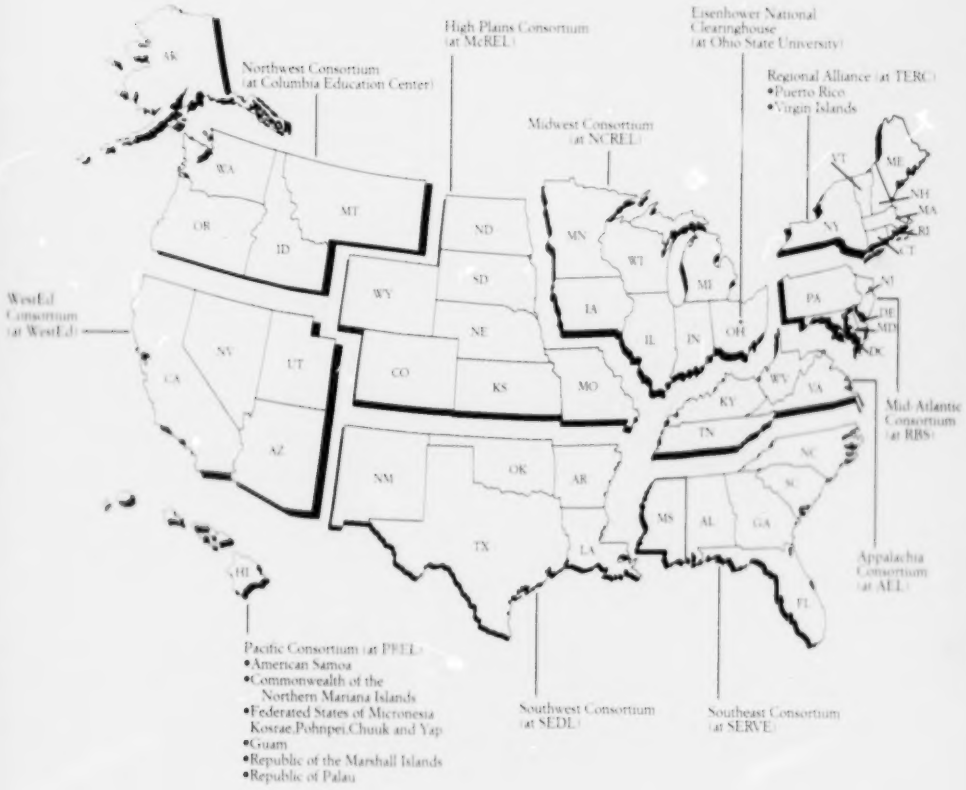


When Congress established the Eisenhower Regional Consortia and National Clearinghouse, it was with the intent that they would collaborate with each other as well as with partners in the region each serves. As the activities highlighted in this report show, the Consortia and Clearinghouse are doing that — they know their clients well and are able to meet their diverse needs. Whether offering a wide variety of training to virtually all the teachers of a region or working intensely and long-term with a few key partners, each Consortium enriches its own region with tailored assistance and knowledge gained from across the network. In turn, each learns from its ongoing experience and feeds new knowledge into the national system.

In this era of ever-increasing demands on those who educate our young, E=MSC^2 represents an active source of knowledge and expertise about improving science and mathematics education that has come to be relied on by educators and policymakers from the local to the national levels. Enriched by their numerous partnerships in services and products over the years, the Eisenhower Consortia and Clearinghouse appreciate the support of their many partners and are eager to continue their contribution to American education in the years ahead.

To benefit from this resource, simply contact the Eisenhower National Clearinghouse or the Consortium that serves your region; all are listed on page 3 of this report.

E=MSC²
EISENHOWER MATHEMATICS & SCIENCE CONSORTIA & CLEARINGHOUSE



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